

ABSTRACT OF THE DISCLOSURE

Overall permreactor-separator process designs and effective permreactor designs with increased mass and heat transfer, reactant conversion, product yield and optional recycling for processing methane, hydrocarbons, alcohols, carbon monoxide, natural gas, acidic natural gas, coal gas, biomass gas, and mixtures of hydrocarbons with carbon dioxide, based on the reforming reactions of these feedstocks with steam and carbon dioxide and the dehydrogenation reactions of saturated hydrocarbons. Final exit streams from these gas phase processors contain pure hydrogen, hydrogen and carbon monoxide mixture, hydrogen and carbon dioxide mixture, and can be used as a direct feed in molten carbonate, solid oxide, proton exchange membrane, alkaline, phosphoric acid and other types of hydrogen driven fuel cells. Same final exit processed streams can be alternatively used for direct chemical synthesis such as methanol, for hydrogenations and hydrogen based reduction reactions such as those of unsaturated hydrocarbons to paraffins, and as feed in power generation systems such as gas turbines and gas engines.